

WHAT IS CLAIMED IS:

1. A semiconductor device having a heat spreader comprising diamond or a diamond-containing material having a thermal conductivity of $350 \text{ W/(m}\cdot\text{K)}$ or more, the heat spreader being directly disposed entirely or partially on the reverse surface of the semiconductor device.

2. The semiconductor device according to Claim 1, wherein the diamond-containing material is a composite of a diamond layer and a ceramic layer or a mixture of diamond particles and ceramic particles, the ceramic layer or the ceramic particles comprising at least one of silicon carbide and aluminum nitride.

3. The semiconductor device according to Claim 1, wherein the heat spreader is directly disposed on a substrate for the semiconductor device.

4. The semiconductor device according to Claim 1, wherein the heat spreader has an irregular surface facing away from the semiconductor device.

5. A semiconductor package accommodating the semiconductor device according to Claim 1, wherein a metal

heat sink or a metal radiating fin is bonded on a surface of the heat spreader facing away from the semiconductor device.

6. The semiconductor package according to Claim 5, wherein a polymer adhesive layer is used to bond the metal heat sink or the metal radiating fin on the surface of the heat spreader, and cilia are formed on the surface of the heat spreader so that the polymer adhesive layer spreads over part of the cilia.

7. A heat spreader disposed on a semiconductor device accommodated in a sealed semiconductor package to dissipate heat from the semiconductor device, the heat spreader comprising:

a diamond layer having a fiber structure across the thickness; and

one or two metal or ceramic members bonded on one or both surfaces of the diamond layer.

8. The heat spreader according to Claim 7, wherein the one or two metal or ceramic members are bonded to the diamond layer with one or two polymer adhesive layers.

9. The heat spreader according to Claim 8, wherein cilia are formed on the one or both surfaces of the diamond

layer.

10. The heat spreader according to Claim 7, wherein the diamond layer has a thermal conductivity of $500 \text{ W/(m}\cdot\text{K)}$ or more across the plane and thickness, and the bonding surfaces of the diamond layer and the one or two metal or ceramic members have a thermal conductivity of $4\times 10^6 \text{ W/(m}^2\cdot\text{K)}$ or more.

11. The heat spreader according to Claim 7, wherein the diamond layer is formed by chemical vapor deposition and has a thickness of 20 to 100 μm .

12. The heat spreader according to Claim 9, wherein the cilia have lengths of 0.2 to 3 μm .

13. A semiconductor package having the heat spreader according to Claim 7.

14. A heat spreader disposed on a semiconductor device accommodated in a sealed semiconductor package to dissipate heat from the semiconductor device, the heat spreader comprising:

a diamond layer having a microcrystalline structure;
and

one or two metal or ceramic members bonded on one or both surfaces of the diamond layer.

15. The heat spreader according to Claim 14, wherein the one or two metal or ceramic members are bonded to the diamond layer with one or two polymer adhesive layers.

16. The heat spreader according to Claim 15, wherein cilia are formed on the one or both surfaces of the diamond layer.

17. The heat spreader according to Claim 14, wherein the diamond layer has a thermal conductivity of $500 \text{ W/(m}\cdot\text{K)}$ or more across the plane and thickness, and the bonding surfaces of the diamond layer and the one or two metal or ceramic members have a thermal conductivity of $4\times 10^6 \text{ W/(m}^2\cdot\text{K)}$ or more.

18. The heat spreader according to Claim 14, wherein the diamond layer is formed by chemical vapor deposition and has a thickness of 20 to 100 μm .

19. The heat spreader according to Claim 16, wherein the cilia have lengths of 0.2 to 3 μm .

20. A semiconductor package having the heat spreader according to Claim 14.